



Workshop Introduction/ Overview of High-Energy X-ray Science at the Advanced Photon Source

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XOR/APS*

*Presented at the Workshop on Science with High-
Energy X-rays*

August 9 & 10, 2004

Argonne National Laboratory



A U.S. Department of Energy
Office of Science Laboratory
Operated by The University of Chicago



Workshop Scope

Main Topics

- **Interaction of high energy x-rays with matter**
- **Unique applications of high energy x-rays in**
 - **Material science**
 - **Atomic science**
 - **Chemical science**
 - **Industrial applications**
- **Science at extreme environments**



Workshop Objectives

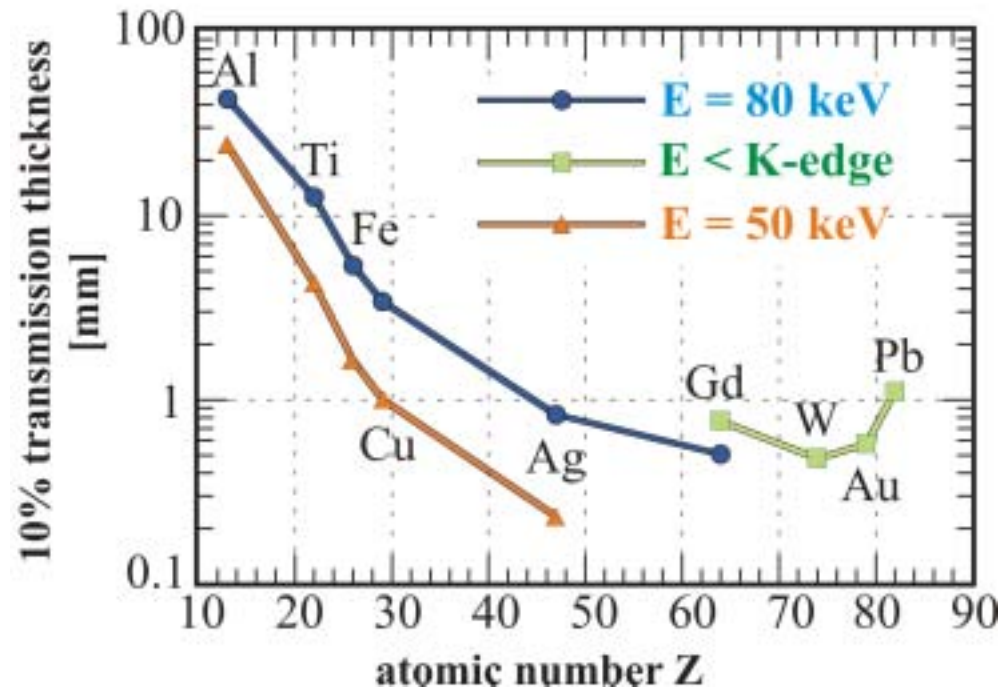
- 1. Explore new and emerging scientific and technological areas defined in the scope of this workshop.**
- 2. Broaden the community interaction by including researchers from various methodologies (e.g., EM, neutron scattering, etc.)**
- 3. Identify new scientific proposals/programs specific to the emerging areas which can benefit from the use of High-Energy X-rays that the participants will bring to the APS during next 5 to 10 years. Also evaluate the capital and operational requirements for these proposals/programs.**
- 4. In addition to available beamline capabilities at the APS, identify future needs to support research in this area of science and technology.**
- 5. Address the need and support for theoretical work to strengthen the experimental research.**
- 6. Prepare a summary document for the archival literature to serve as a roadmap for the future applications of high-energy x-rays and suggest the role of the Advanced Photon Source towards this objective.**



High-Energy X-rays: Why should anyone care?

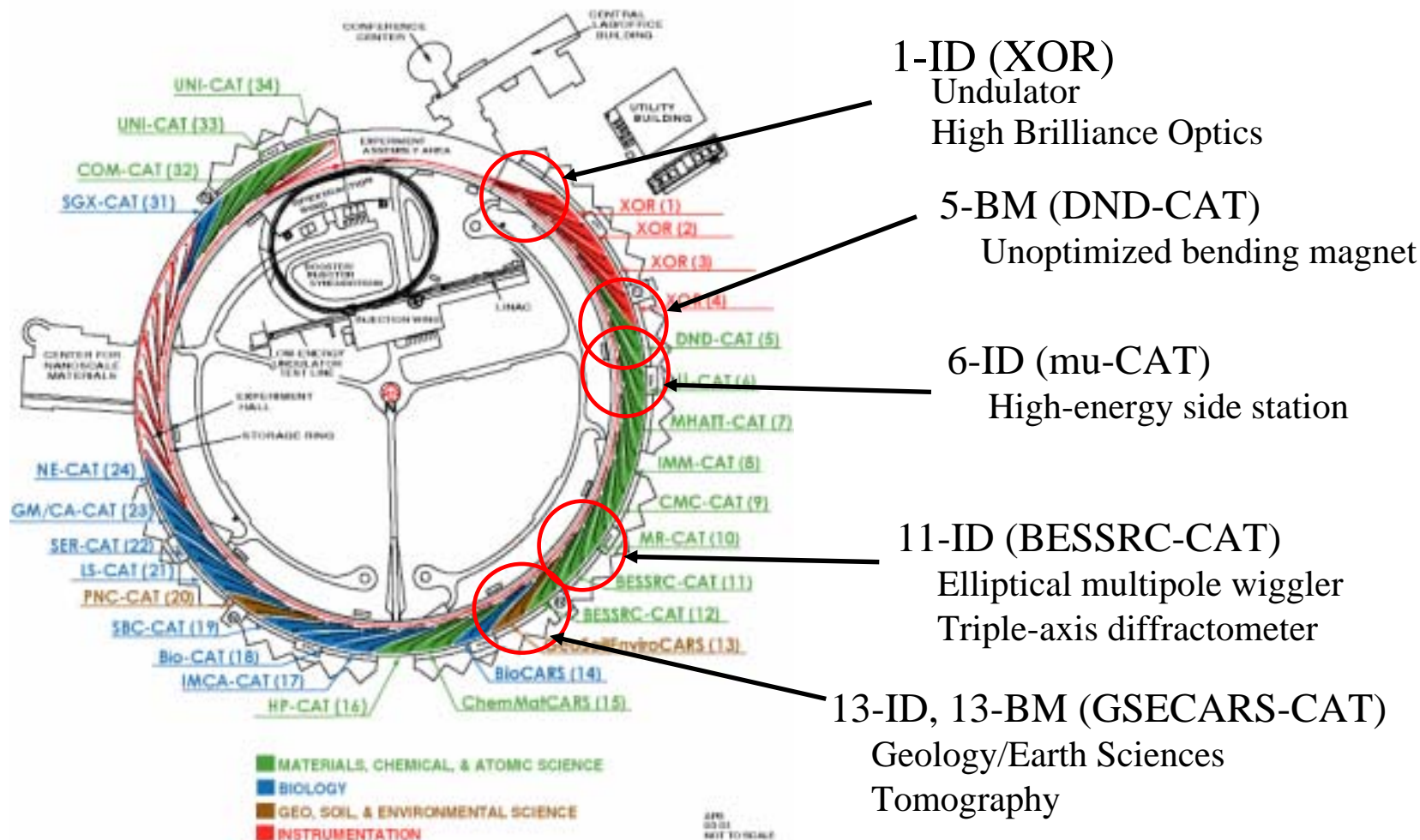
My definition ⇨ Photons between 35-200 keV
50 - 90 keV

- **Low Absorption**
 - Bulk measurements
 - Special environments
 - Often comparable to neutrons
- **Simplified Scattering Processes**
 - Kinematical diffraction
 - Small absorption, polarization, & dispersion corrections
- **Small Diffraction Angles**
 - Large Q range



APS High Energy X-ray Capabilities

APS Collaborative Access Teams by Sector & Discipline



Grand Challenges

Question for the workshop audience:

What are the “Grand Challenges” in science that can be addressed using high-energy x-rays?

Science Challenges

In situ studies of materials processing under “realistic” conditions

High temperature

High pressure

Harsh environments

In situ studies of chemical processes

Mechanical behavior of individual grains within a bulk material

Studies of welds and the welding process

Accurate crystallography of materials with high-Z elements

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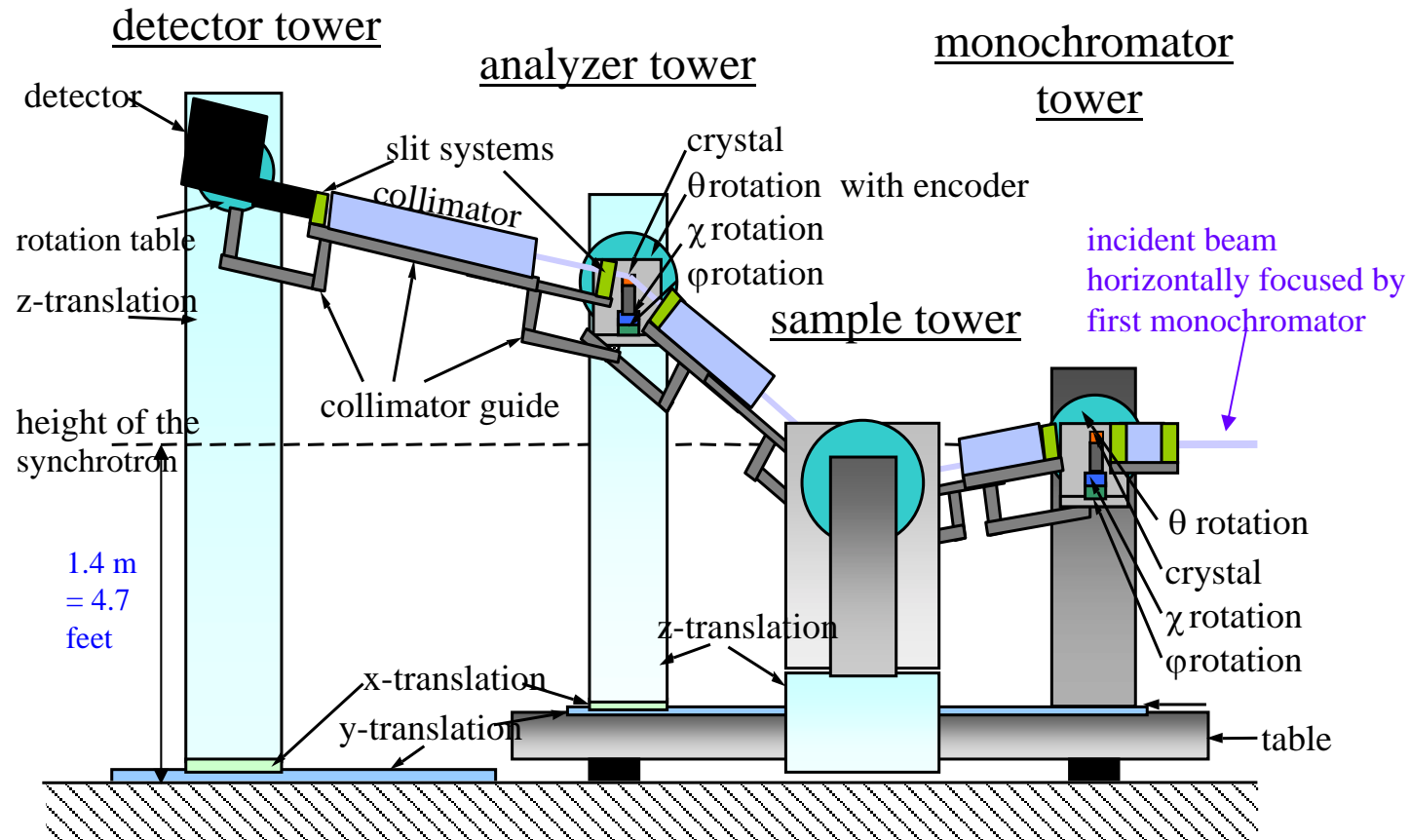
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Practical Challenges

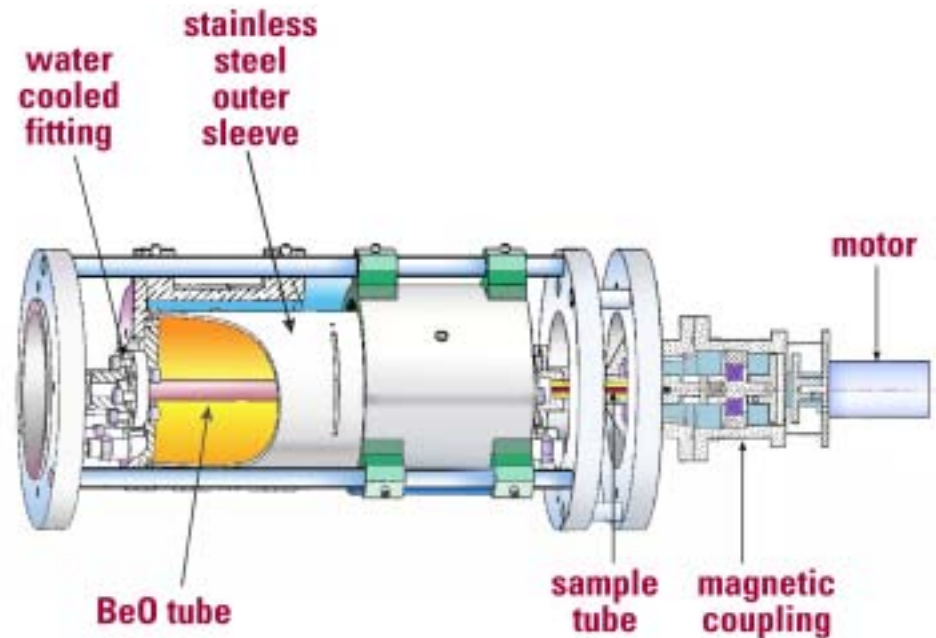
Developing dedicated high-energy x-ray
instruments at the APS

Triple-Axis Diffractometer at 11-ID



Practical Challenges

Developing dedicated high-energy x-ray
instruments at the APS



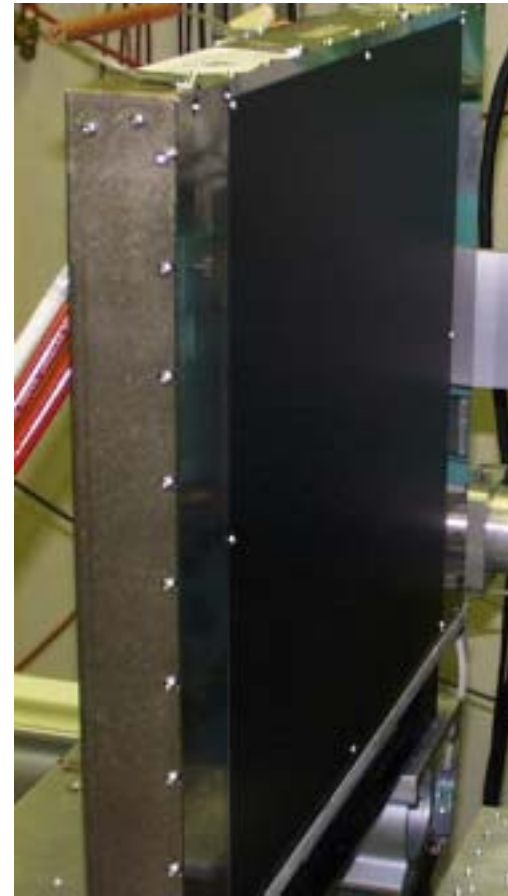
Kramer, Margulies, McCallum, Zhao,
Goldman, Lee, & Haeffner



Practical Challenges

Developing dedicated high-energy x-ray instruments at the APS

Obtaining large, efficient 2D detectors for high-energy x-rays
e.g., the GE angio detector



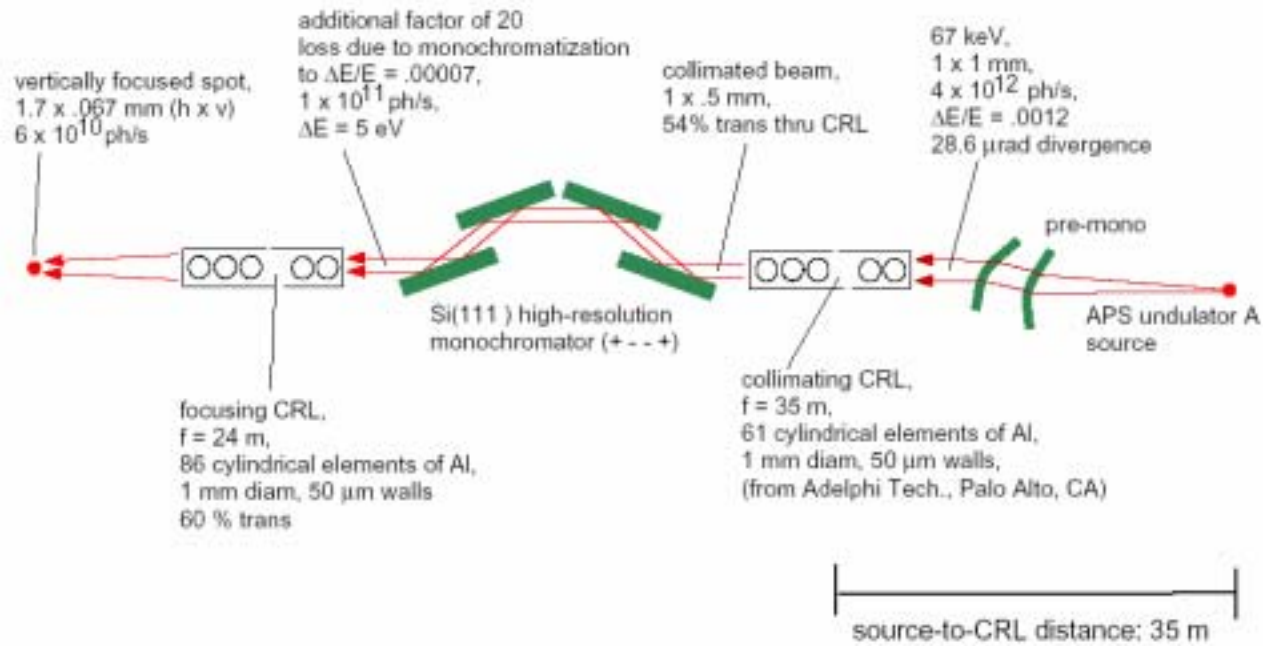
GE angio detector

Practical Challenges

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Optimizing high-energy x-ray optics



Practical Challenges

- Developing dedicated high-energy x-ray instruments at the APS
- Obtaining large, efficient 2D detectors for high-energy x-rays
e.g., the GE angio detector
- Optimizing high-energy x-ray optics
- Development of high quality, user friendly analysis software for a variety of techniques

Practical Challenges

Developing dedicated high-energy x-ray instruments at the APS

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Development of high quality, user friendly analysis software for a variety of techniques

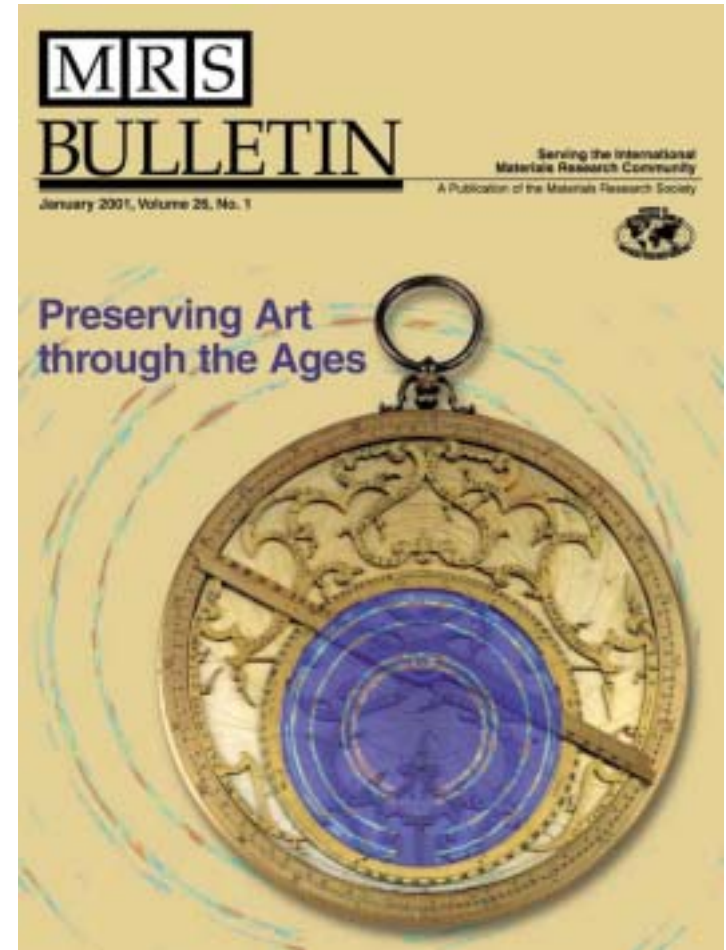
Optimizing the source for high-energy x-ray production

Specialized undulators



Practical Challenges

- Developing dedicated high-energy x-ray instruments at the APS
- Obtaining large, efficient 2D detectors for high-energy x-rays
e.g., the GE angio detector
- Optimizing high-energy x-ray optics
- Development of high quality, user friendly analysis software for a variety of techniques
- Optimizing the source for high-energy x-ray production
 - Optimized undulators
- Developing the user community for high-energy x-rays
 - New communities



Practical Challenges

Developing dedicated high-energy x-ray
instruments at the APS

Obtaining large, efficient 2D detectors for
high-energy x-rays
e.g., the GE angio detector

Optimizing high-energy x-ray optics

Development of high quality, user friendly
analysis software for a variety of
techniques

Optimizing the source for high-energy x-ray
production

Optimized undulators

Developing the user community for high-
energy x-rays

New communities

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Charge to the Participants

1. Identify “Grand Challenges” (science and technological) to be addressed during the next 5-10 years which require or high energy x-rays
2. Identify and justify the technical requirements to meet the Grand Challenges
 - New instrumentation and techniques that need be developed on existing beamlines to perform new kind of science.
 - Need for a new dedicated beamline(s) for this community
3. Identify R&D areas that will prepare the community to address the Grand Challenges



Workshop Report

A report will be prepared (probably an ANL Technical Bulletin) on the workshop. Also a summary will appear in Synchrotron Radiation News.

Towards this end:

- The summaries and slides provided by the speakers of the talks can be accessed directly by clicking the “Summary” or “Slides” in the “Program” on the workshop webpage.**
- You can continually input your thoughts using the “Swiki” software linked to the lap-top using Wi-Fi. Input can be made even after the workshop. For inclusion in report, please give input by 8/20/04.**

<http://swiki.anlgh.org/Hex>

User: [hex](#) (lower case)

Password: [stress](#) (lower case)

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- **Address the applicable objectives in each of the topics in the scope of the workshop and make recommendations to the APS.**
- **On Tuesday afternoon there will be discussion sessions at the parallel session to generate input for the report.**



APS Strategic Planning Meeting

Future Scientific Directions for the Advanced Photon Source– Strategic Planning Meeting

September 2 & 3, 2004

Fontana, Wisconsin

www.future.aps.anl.gov/Future/Strategic_Planning_Meeting/home.htm



APS Strategic Planning Meeting

	Thursday Sept. 2, 2004	Friday Sept. 3, 2004
8:00 am	Introduction & Charge	
8:30 am	Report on Time Domain Science Workshop	Report on Nanomagnetism Workshop
9:30 am	Report on Inelastic X-ray Scattering Workshop	Report on Big Magnet
10:00 am	Break	Break
10:30 am	Report on Emerging Scientific Opportunities using Imaging Techniques Workshop	Report on Science with High-Energy X-rays Workshop
11:30 am	Report on Meso/Nanosopic Science Workshop	Report on Emerging Areas of Biological Crystallography Workshop
12:30 pm	Lunch Break	Lunch Break
2:00 pm	Report on Membrane Science Workshop	Discussion and Wrap-Up
3:00 pm	Report on BES-Funded Sectors Science	
3:30 pm	Break	
4:00 pm	Report on Environmental Science Workshop	Adjourn
5:00 pm	Report on Frontier Science using Soft X-rays Workshop	
6:30 pm	Dinner	

Workshop Program

Monday, August 9

AM:

Plenary Sessions (A1100)
Lunch (5th Floor Gallery)

PM:

Plenary Sessions (A1100)
Group Photo
Tours/Posters
6:30 No Host Dinner
(ANL Guest House)

Tuesday, August 10

AM:

Parallel Sessions (A: A1100, B: A5000)
Lunch (5th Floor Gallery)

PM:

Parallel Sessions (A: A1100, B: A5000)
Parallel Breakout Discussions
A: Ersan Üstündag (Discussion Leader)
B: Angus Wilkinson (Discussion Leader)
Joint Summary Session (A1100)

